

# Ion Mobility Spectrometry for Water Monitoring

Completed Technology Project (2012 - 2012)



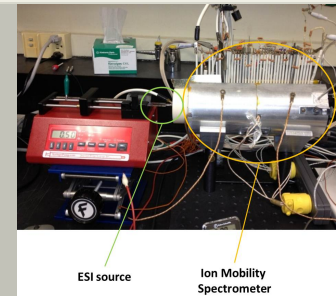
## Project Introduction

Current water quality monitors aboard the International Space Station (ISS) are specialized and provide limited data. As water and air samples are often analyzed using similar ground-based techniques, it seems logical to use a combined instrument in flight. Of the instruments that measure air and water quality, air monitors provide more detailed information. We therefore propose to construct an ion mobility spectrometer with the ability to measure both air and water samples. We have recently prepared an electrospray ionization (ESI) source that will allow analytes to be liberated from the water matrix. This source will be interfaced with the constructed ion mobility spectrometer and used to analyze different water samples. Upon the successful completion of this work, it will have been demonstrated that the volatile organic composition of water samples can be measured using an air analyzer and more detailed information can be obtained than is currently available in real-time monitors.

The Colorimetric Water Quality Monitor Kit (CWQMK) and the Total Organic Carbon Analyzer (TOCA) are used to measure biocide concentrations and the total organic carbon load, respectively. While each of these instruments provides important analytical information, they lack the ability to fully characterize the organic and inorganic compounds present in the ISS water systems. Identification of individual compounds requires the return of ISS archival samples that are analyzed in ground laboratories. A survey of the other environmental monitoring hardware used on the ISS reveals that air quality monitors have advanced further toward the end goal of providing real-time, compound-specific information that can be used by the crew. As many of the organic compounds on the target lists for air and water quality monitoring are identical, evaluating the current air quality monitoring technologies is a logical first step toward development of a water quality platform that can characterize the organic load in spacecraft water systems. The initial phase of this effort is focused on ion mobility spectrometry (IMS). IMS technology was previously used in the ISS Volatile Organic Analyzer (VOA), and it is employed for numerous terrestrial applications, such as the detection of a variety of large analytes in aqueous solution. It also is widely field-deployed by the Department of Homeland Security for explosives detection. Our approach couples IMS with electrospray ionization (ESI) to ionize and detect target analytes in water samples. The successful completion of this work could potentially allow for the analysis of both air and water samples using a single instrument.

## Anticipated Benefits

The infusion potential of electrospray lies in its potential to be interfaced with types of instrumentation previously or currently used on ISS. These include differential mobility spectrometry (Air Quality Monitor) or ion mobility spectrometry (Volatile Organic Analyzer). The ability to analyze water



Project Image Ion Mobility Spectrometry for Water Monitoring

## Table of Contents

Project Introduction	1
Anticipated Benefits	1
Primary U.S. Work Locations and Key Partners	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3

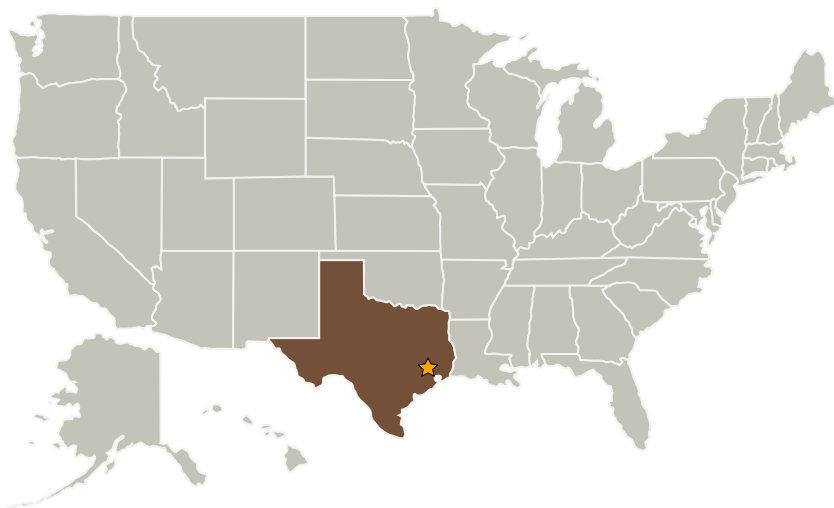
# Ion Mobility Spectrometry for Water Monitoring

Completed Technology Project (2012 - 2012)



samples in real time makes ESI-IMS a potential ionization source for future exploration missions. Additionally, the ability to analyze both air and water samples with a single instrument will reduce the volume and mass requirements of environmental monitors.

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Wyle Integrated Science and Engineering Group	Supporting Organization	Industry	

## Primary U.S. Work Locations

Texas

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

Center Innovation Fund: JSC CIF

## Project Management

### Program Director:

Michael R Lapointe

### Program Manager:

Carlos H Westhelle

### Project Manager:

Ariel V Macatangay

### Principal Investigator:

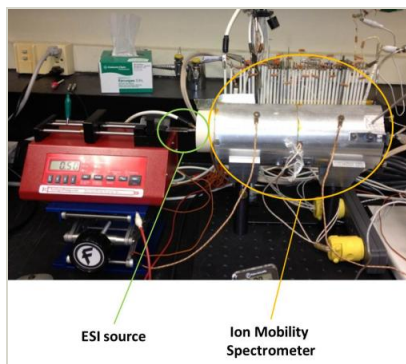
William T Wallace

## Ion Mobility Spectrometry for Water Monitoring

Completed Technology Project (2012 - 2012)



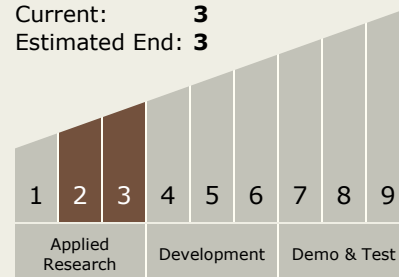
## Images

**12433-1377012786402.jpg**

Project Image Ion Mobility Spectrometry for Water Monitoring  
 (<https://techport.nasa.gov/image/2238>)

## Technology Maturity (TRL)

Start: **2**  
 Current: **3**  
 Estimated End: **3**



## Technology Areas

## Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.4 Environmental Monitoring, Safety, and Emergency Response
    - └ TX06.4.1 Sensors: Air, Water, Microbial, and Acoustic